CLAIMS

WHAT IS CLAIMED IS:

1. A device for sorting biological material comprising:

a microfabricated substrate having at least one main channel and at least two branch channels which meet at a junction,

a detection region upstream and proximate to the junction comprising a detection apparatus for evaluating the biological material according to at least one characteristic as the material passes through the detection region,

a discrimination region downstream from the detection region,

a flow control system responsive to the detection apparatus and adapted to direct biological material through the discrimination region into a branch channel.

2. A device of claim 1, wherein at least one of the main and outlet channels communicates with a reservoir.

3. A device of claim 1, wherein the substrate is comprised of silicon.

4. A device of claim 1, wherein the substrate comprises a silicone elastomer.

5. A device of claim 1 wherein the biological material comprises cells.

6. A device of claim 4 wherein the silicone elastomer substrate is made from an impression of an etched silicon wafer.

7. A device of claim 1 wherein the flow control system is electro-osmotic

8. A device of claim 1 wherein the flow control system is electrophoretic.

9. A device of claim 1 wherein the flow control system is dielectrophoretic.

10. A device of claim 1 wherein the flow control system is pressure driven.

11. A device of claim 1 wherein the flow control system is microvalve.

12. A device of claim 1 wherein the flow control system is optical trapping.

13. A device of claim 1 wherein the flow control system is flow stoppage-based control.

14. A device according to claim 1 wherein the flow control is provided by a voltage gradient between the branch channels and the junction.

15 A device according to claim 14 wherein the voltage gradient is generated by electrodes in the branch channels.

16. A device of claim 1 wherein the flow control is by a pressure gradient between one or more channels and the junction.

17. A device of claim 16 wherein pressure driven flow control is provided by capillary action at one or more channels of the substrate.

18. A device of claim 1 wherein the flow control comprises one or more valves.

19. A device of claim 17 wherein the flow control comprises one or more valves.

20. A device of claim 1 wherein the flow control is reversible.

21. A device of claim 1 wherein the characteristic is optically detectable.

22. A device of claim 1 wherein the characteristic is determined by a fluorescent reporter.

23. A device of claim 1 wherein the characteristic is determined by a chemiluminescent reporter.

24. A device of claim 1 wherein the characteristic is determined by a radioactive reporter.

25. A device of claim 1 wherein the characteristic is determined by a spectroscopically detectable reporter.

26. A micro-fabricated sorter according to claim 1 wherein the predetermined characteristic is size.

27. A device of claim 1 wherein the detection apparatus comprises a light scattering apparatus.

28. A device of claim 1 wherein the detection apparatus comprises an apparatus for recognizing electromagnetic radiation.

29. A device of claim 28 wherein the detection apparatus further comprises a source of electromagnetic excitation.

30. A device of claim 29 wherein the excitation source is a light source and the recognizing apparatus is a charge coupled device.

31. A device of claim 1 wherein the detection apparatus comprises at least one of photomultiplier tubes and photodiodes.

32. A device of claim 1 wherein the detection apparatus is positioned to target biological materials within a predetermined detection region.

33. A device of claim 1, wherein the width and height of a channel of the device is at least about two times as large as the diameter of the largest material to be sorted.

34. A device of claim 1, wherein a channel is from about 20 μm to 200 μm wide and about 20 μm to 200 μm deep.

35. A device of claim 1, wherein the biological material is a cell having a predetermined characteristic that is identified according to a reporter signal selected from a dye, fluorescent agent, chemiluminescent agent, chromophore, radio-isotope, and optically detectable protein.

36. A device of claim 35, wherein the control of flow is selected from electro-osmotic, electrophoretic, dielectrophoretic, pressure driven, microvalve, laser trapping and flow stoppage-based control.

37. A device of claims 36 wherein the control of flow is reversible.

38. A method for sorting a fluid mixture of cells comprising:

providing the mixture of cells to a main channel of a microfabricated substrate, wherein the main channel is in fluid communication with at least two downstream branch channels which meet at a junction;

producing a flow of fluid in the channels;

interrogating each cell for a predetermined characteristic as it passes a detection region associated with the main channel;

generating a signal indicating the results of the interrogation;

directing the flow of each cell into a selected branch channel according

to the signal.

39. A method of claim 38 wherein the width and height of each channel is at least about two times as large as the diameter of the largest cell in the mixture of cells.

40. A method of claim 38 wherein the characteristic is an optically detectable reporter in or on the cells.

41. A method of claim 38 wherein the cells are interrogated by at least one device selected from the group of microscopes, diodes, light stimulating devices, lasers, light scattering apparatuses, electromagnetic excitation sources, electromagnetic radiation detector apparatuses, photomultiplier tubes, and processors.

42. A method of claim 38 wherein the reporter is selected from a dye, fluorescent agent, chemiluminescent agent, chromophore, radio-isotope, and optically detectable protein.

43. A method of claim 38 wherein the flow is controlled by electro-osmosis, electrophoresis, dielectrophoresis, pressure gradient, microvalve, optical trapping and flow stoppage.

44. A method of claim 43 wherein the flow control is provided by a voltage gradient between the branch channels and the junction.

45. A method of claim 44 wherein the voltage gradient is generated by electrodes in the branch channels.

46. A method of claim 44 wherein the main channel comprises an electrode.

47. A method of claim 43 wherein the flow control is by a pressure gradient between one or more channels and the junction.

48. A method of claim 43 wherein the pressure gradient is provided by capillary action at one or more channels of the substrate.

49. A method of claim 38 wherein the flow control comprises one or more valves.

50. A device of claim 38 wherein the flow is reversible.